DOCUMENT RESUME

ED 192 906 PS 011 730

AUTHOR Dunn, Phillip C.
TITLE The Implementation of Photographic Visual Problem Solving Strategies to Enhance Levels of Visual Perception in Elementary School Art Students.
PUB DATE [76]
NOTE 27p.

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Art Education; *Design; *Elementary School Students; Perception Tests; Photography; Pretests Posttests; *Problem Solving; *Training; *Visual Literacy; *Visual Perception

ABSTRACT

This study investigates the relationship of teaching strategies emphisizing visual problem solving through the medium of photography to increased visual perceptual levels in second and third grade students. Twenty-five subjects from three classroom groups were randomly assigned to one of three treatment groups labeled Perceptual Principles Group 1, Elements of Design Group 2, and Control Group 3. Groups 1 and 2 were given 15 simple, self-processing still cameras and film. Both experimental groups received examples and classroom discussion that pertained to visual problem solving and perceptual principles. Treatment for Group 1 focused on five visual perceptual principles: point of view, space, motion, points of maximal information, and the perception of an event. Treatment for Group 2 emphasized five elements of design: line, shape, texture, space and color. As measures of subjects' visual perceptual ability, two standardized instruments and a rating scale were employed in a pre-test, treatments, post-test design. The instruments were (1) the Children's Embedded Figures Test (CEFT); (2) the Motor-Free Visual Perception Test (MVPT); and (3) the Dunn Photographic Rating Scale (DPRS). Among the results it was found that Group 1 made significantly greater performance gains on the CEFT than did Groups 2 or 3; that there were no significant performance differences on the MVPT and that there were significant differences on the DPRS between Groups 1 and 2, with Group 1 subjects performing at higher levels than Group 2. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED192906

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: PS SO
In our judgement, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

THE IMPLEMENTATION OF PHOTOGRAPHIC VISUAL PROBLEM SOLVING STRATEGIES TO ENHANCE LEVELS OF VISUAL PERCEPTION IN ELEMENTARY SCHOOL ART STUDENTS

BY

DR. PHILLIP C. DUNN
ASSISTANT PROFESSOR OF ART
UNIVERSITY OF SOUTH CAROLINA
COLUMBIA, SOUTH CAROLINA

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Phillip C. Dunn
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

PS011730

Recently, some researchers in art have begun to explore visual perceptual development in children with the objective of increasing or developing the child's visual perceptual level (Salome, 1965; Dorethy, 1972; Salome and Szeto, 1976). One of the integral aspects shared by this body of research is the evaluation of subject levels of performance through activity in the traditional productive domain of art. While physical evidence of each subject's performance is certainly necessary, this methodology may fail to adequately account for a significant factor in attempting to evaluate visual perceptual development in children. Cognitive visual perceptual skills may be more highly developed than children are able to demonstrate when functioning with traditional art media. The psychomotor skills needed to manipulate traditional art media may, in fact, be an intervening variable that confounds not only the initial measure of a subject's visual perceptual level, but also may hinder or delay the exhibition of increases in visual perceptual ability as the child matures.

The photographic medium offers an alternative to traditional art media in the study of visual perceptual development in children. Firstly, the photographic image shares a common aesthetic basis with other two-dimensional art media (Ohrn, 1976). Secondly, photography is a familiar form of visual expression to contemporary children who experience photo-generated images on a continuing basis (Barley, 1969). And thirdly, activity in photography can be structured so that psychomotor skills are greatly reduced in terms of their importance in the resulting products. In essence therefore, the underlying assumption of this study rests on

the possibility that because of photography's limited reliance on psychomotor skills, a more accurate evaluation of a subject's initial level of visual perception is possible, and that any enhancement of this level may also be more accurately measured.

The psychological studies and theories of Attneave (1955), Allport (1954), Gibson (1969) and Piaget (1956) imply that the development of perceptual skills involves active, firsthand experiences in the environment. Certain covert activities engaged in by the preceiver may become habitual and can limit the possible perceptual orientations or differentiation of new visual stimuli. Perception is often holistically founded, and the presence of redundant information in the visual field may encourage the perceiver to come to premature closure in the perceptual act. Moreover, excessive reliance on visual constancies may extend beyond the limits of perceptual economy to hinder the perceiver's ability to process visual information or engage in visual perceptual problem solving.

Dorethy (1972) achieved significant results in altering the visual perception of first graders by using motion pictures that were rich in monocular clues, texture gradients, overlap and proximity as stimuli for perception. Salome's (1965) study pointed toward the assumption that teaching methodology and training tasks could cause changes in the levels of visual perceptual ability to occur in middle elementary school children.

Unfortunately there is a paucity of research studies that deal with photography as an educational tool. Most of the available related photographic literature deals with visual literacy in terms of aiding children in achieving readiness for reading tasks. One assumption

OCT 6 1980

shared by much of this literature is the notion that intellectual growth often begins to slacken when children enter school and are encouraged to subjugate visual information (Debes, 1975). Barley (1969) notes that child arranged photographic sequences help bridge the gap between visual and verbal symbols, and Fransecky (1972) states that photographic activity helps the child to concentrate on a specific part of the environment. Villa (1973) cited increases in visual awareness in four year old students who engaged in photographic activities. In addition, the manipulative abilities of these children were clearly well developed enough for them to operate the cameras with little or no difficulty.

The researchers contend that children, especially disadvantaged or culturally different children, maintain a highly visual orientation to the environment until the educational system requires them to de-emphasize visual perceptual skills in favor of language skills and word symbols. The presence of visual media in several forms and on a continuing basis in our society presents education with the task of producing individuals who are both visually and verbally literate.

The problem solving aspects of developing increased levels of visual differentiation may be used so frequently by the individual that they are almost completely internalized, but they are operative nonetheless. Problem solving can be thought of as a learning process (Gagne, 1970), and as such, coincides with Piaget's (1960) stance that, as the individual matures, perceptual activities are increasingly directed by the active operation of the intellect.

Gagne also cites another important component to the conditions necessary for problem solving that has relevance in the educational

schema, guided discovery. Guided discovery, in this instance, is any assistance rendered that can aid the individual in achieving contiguity of relevant principles and rules without actually presenting a proposed solution to the problem.

Theorists concerned with learning often consider problem solving to be an important process that is closely connected with increases in cognitive development. Children seem to engage in problem solving activities on a continuing basis as they experience their environment in an active, firsthand way. The quality of learning that results from problem solving also appears stronger and more resistant to interference than many other types of learning. Successful problem solving may maintain, if not enhance, the child's ability and desire to continually increase his experiential knowledge base.

The problem to be investigated in this study revolves around the perceptual problem solving efforts of children as they experience the environment, and the development of a vehicle that will allow children to express themselves more adequately. Specifically, is there a relationship between teaching strategies that emphasize active visual problem solving through the medium of photography, and the development of increased visual perceptual levels in second and third grade art students? The purpose of this research is to develop and administer a series of treatments that result in evidence of visual problem solving ability changes and increased levels of visual differentiation in children.

METHOD

The subjects utilized in this investigation were male and female second and third grade students at the Burris Laboratory School in

Muncie, Indiana, during 1978. The second and third grade population of the Burris School consisted of four classroom groups, each combining the two grade levels into a single classroom unit. Eighty-seven (87) students were included in both the initial pilot study and the three intact classroom groups that participated in the final form of the study. Twelve of these students participated solely in the pilot study, while 75 other subjects, 37 males and 38 females, were equally divided between the three groups that made up the final sample.

Enrollment in the Burris Laboratory School, a 750 student, K-12 institution, is open to all students within the state of Indiana. The vast majority of students, however, resided in Muncie and the surrounding rural areas. The socioeconomic status of these students included a variety of racial, ethnic, rural, and urban backgrounds. The classroom groups were assumed to be a random sampling of the population due to the mixed nature of their socioeconomic status and their initial random assignment to the four classroom groups. In addition, a table of random numbers was employed to assign experimental treatments to the intact groups.

The three experimental groups were labeled Perceptual Principles Group 1, Elements of Design Group 2, and Control Group 3. Each group contained 25 subjects. The duration of the study was approximately four weeks including three to four days of both pre-testing and post-testing. Experimental treatments occurred during five one hour time periods on an every other day basis for Groups 1 and 2.

INSTRUMENTATION

Two standardized instruments and a rating scale developed specifically for this study were employed as measurements of visual perceptual ability: 1) The Children's Embedded Figures Test (CEFT), 2) The Motor-Free Visual Perception Test (MVPT), and 3) The Dunn Photographic Rating Scale (DPRS).

The CEFT is a widely employed perceptual instrument based on Witkin's (1962) work concerning perceptual differentiation. Normative data for the CEFT supports the position that this instrument is a valid and reliable measure for levels of perceptual differentiation in children (Tryon, 1957; Witkin, 1971). The CEFT measures a subject's ability to disembed simple geometric shapes from a more complex structure.

The MVPT is another device for measuring visual perceptual ability, but in addition, this instrument seeks to eliminate any limitations in measurement that could be due to varying levels of psychomotor development in subjects (Colarusso and Hammill, 1972). The MVPT correlates favorably with other tests of visual perception. Of particular interest is the MVPT's significant .73 correlation with the well known Frostig Developmental Test of Visual Perception.

The DPRS was employed to measure the presence of treatment effects upon the visual orientation of treatment Group 1 (Visual Perceptual Principles Treatment), and treatment Group 2 (Visual Elements of Design Treatment). Photographic activity within treatment Groups 1 and 2 was rated according to a two section, multi-part scale consisting of a weighted rating for Initial Visual Response to the photographic image, and the following visual principles: Visual Balance, Visual Emphasis, Visual Proportion, Visual Unity, and Originality/Inventiveness. Each

category of the rating scale was scored by three trained judges. This rating was employed for further analysis regarding individual and group performance. Since Group 3 was not involved with the photographic medium, the DPRS could not be administered to them.

In order to assess the reliability of judges' performance with the rating scale, correlation coefficients were calculated for a sampling of 30 photographs produced by the treatment groups during photographic activities of the investigation. The reliability estimates computed for this sampling of images produced inter-rater correlation coefficients of .89, .97 and .86. These results suggested that the correlation between independent rater evaluations were highly reliable, therefore, employment of the DPRS was continued.

In addition, ongoing evaluations were obtained by analyzing the scores produced for ten photographs selected at random from the second portfolio to be rated by each judge. This analysis produced inter-rater correlation coefficients of .92, .97, and .95 for rater comparison over the ten images. These results suggested that the correlation between independent rater evaluations continued to be reliable as the judges progressed through the task of evaluating over 500 images.

After the entire sample of photographic images was rated, reliability estimates were computed to assess inter-rater agreements between the three judges and the two experimental groups. To evaluate the reliability of the rating scale in each of the experimental treatments, correlation coefficients were computed for 500 randomly selected photographs from groups 1 and 2 over the five treatments. These correlation coefficients are presented in Table 1.

Correlation coefficients resulting from this analysis indicated a high degree of reliability between the judges for the photographic task evaluations.

Table 1

COEFFICIENTS OF CORRELATION BETWEEN THREE JUDGES FOR INTER-RATER AGREEMENT ON PHOTOGRAPHS FROM EACH OF THE FIVE EXPERIMENTAL TREATMENTS

Treatment	Photograph I			Photograph II		
	DPRS	Sec I	Sec II	DPRS	Sec I	Sec II
1		.98075**	.97736**		.82555**	.70701**
2		.97616**	.95781**		.83916**	.78313**
3		.68194**	.93769**		.98186**	.96465**
4		.95720**	.83664**		.96187**	.95563**
5		.99093**	.77289**		.97693**	.97830**

*p.$\leq$.05
**p.$\leq$.01

The Dunn Photographic Rating Scale was developed specifically for this study. Except for the informal analysis of data gathered during the preliminary study, no prior information concerning the reliability and validity of the instrument was available. Since a theoretical basis for the construction of this scale is available, and expert opinion played a part in the construction of the instrument, face and content validity has been assumed. The high levels of inter-rater correlation on the scale do lend some credence to the evaluation's objectives since the raters were all trained artists who were highly experienced in evaluating visual images.

TREATMENT

The differentiation theory of Gibson (1969) and the problem solving concepts of Gagne (1970) were combined to form the treatment methods for this study. Gibson defined perception in terms of levels of specificity in response to increasingly complex stimuli from the visual array. Three processes were also identified that serve to aid the child in achieving increases in differentiation ability through experiences in environment. These processes were 1) abstraction of differential properties of stimuli, 2) filtering out irrelevant information from the visual array, and 3) selective attention described as exploratory activity of the sense organs.

Gagne explored the perception/learning situation in another way when he assumed the position that learning, especially the type of learning that comes from firsthand experiences with the environment, may well be thought of as a problem solving process. Gagne further stated that problem solving requires specific skills in order to achieve a satisfactory solution. Contiguity, the ability to keep all of the relevant bits of information in mind simultaneously, was held to be of paramount importance in problem solving. Finally, Gagne proposed that the learning in the problem solving process is of a higher order than many other types of learning. He noted that learning resulting from problem solving can often be generalized from a specific situation to solve an entire class of related problems whereas recall, for example, is limited to application in a specific instance only.

The work of Hurwitz (1964), Collier (1967), and Linderman and Herberholz (1974) provided insight into the qualitative aspects of

visual images. Several concepts relating to the evaluation of art and the general goals of those who express themselves visually were of value in constructing the visual problem solving treatments emphasizing the Elements of Design. While art is commonly thought to be highly emotional, subjective and personalized in character, quantifiable rules and guidelines for the production and evaluation of images have been described. Elements such as line, shape, texture, space, and color, have often been typically stressed in production oriented studio art programs. When the extent to which these criteria are present in a visual image has been assessed, an evaluation has occurred.

The treatment series utilized in Groups 1 and 2 consisted of five sessions of approximately one hour each. Each group was provided with 15 extremely simple self-processing still cameras and film. After instruction in camera operation, the groups experienced both visual examples and classroom discussion that pertained to Visual Problem Solving.

For the purposes of this study, Visual Problem Solving was defined as: An approach to differentiating in the visual array whereby the subject is assisted in achieving a state of contiguity through task orientation so that visual perceptual problems may be defined, possible solutions proposed and tested until a satisfactory response is realized. Throughout the treatment sessions, frequent attempts were made to assist the subjects in achieving a state of contiguity. A guided direction approach was instituted so the subjects could begin to actively draw from a growing knowledge base of visual perceptual principles in achieving solutions to their photographic assignments. At the end of each session,

subjects were allowed to produce up to five photographs pertaining to the perceptual principle that had just been explored. The maximum number of photographs produced by a subject in Group 1 or Group 2 during the treatment series was 25.

In addition to the above, treatments for Perceptual Principles Group 1 centered around the following Visual Perceptual Principles. One treatment session was devoted to each principle.

1. Point of View - A visual perceptual principle that attempts to sensitize the subject to the relationship between viewer position and the appearance of stimuli in the visual array.

2. Space - A visual perceptual principle that attempts to sensitize the subject to the relationship between the perceiver and the relative distances between visual stimuli.

3. Motion - A visual perceptual principle that attempts to sensitize the subject to various ways of apprehending stimuli in the visual array that change position.

4. Points of Maximal Information - A visual perceptual principle that attempts to sensitize the subject to parts, areas, or contours of stimuli in the visual array that yield more visual information about the stimuli than other less important areas.

5. Perception of an Event - A visual perceptual principle that attempts to sensitize the subject to the passage of time as a stimuli in the visual array changes position.

The treatments for Group 2, however, emphasized the Elements of Design as the means to achieve visual solutions rather than visual perceptual training through Visual Perceptual Principles oriented visual problem solving tasks. For the purposes of this study the Elements of Design were defined as: The basic visual qualities that are generally considered to be the foundation for the production of visual art. Among these elements are: line, shape, texture, space, and color. One treatment session was devoted to each of the above elements.

In addition, this treatment series may have had added significance to the experiences of the subjects since the Elements of Design are often stressed in typical studio oriented school art programs. Mastery of these concepts has usually been considered crucial by art educators to developing visual awareness in children and the corresponding skills for effective expression in visual terms (Yochim, 1967).

Control Group 3 received no specific instruction in perceptual principles, visual problem solving, or the Elements of Design. Other than pre-testing and post-testing, the Control Group had no contact with the researcher or the photographic medium during the period of data collection. The information obtained from the Control Group was used solely for test-retest reliability estimates on the standardized perceptual instruments.

Since this study made use of intact classroom groups, freedom from sampling bias was not assumed even though the original assignment to classroom groups by school administrators and assignment to experimental group status was performed in a random fashion. Multivariate statistical analysis of the research data was considered to be appropriate since the Double Precision Version of Univariate and Multivariate Analysis of Variance and Covariance method takes into account initial differences in the experimental groups as illuminated by pre-test measures. By utilizing the pre-test scores as the covariate, the computer generated analysis was employed for hypothesis testing.

FINDINGS

The analysis of covariance generated pre-test, post-test, and adjusted post-test means for group performance on both the CEFT and the

MVPT, Univariate F-ratio techniques were utilized to analyze and determine the significance of differences between groups. The pre-test, post-test, and adjusted post-test means for all groups have been presented in Table 2.

TABLE 2

PRE-TEST, POST-TEST, AND ADJUSTED POST-TEST MEANS FOR PERCEPTUAL PRINCIPLES GROUP 1, ELEMENTS OF DESIGN GROUP 2, AND CONTROL GROUP 3
A) THE CHILDREN'S EMBEDDED FIGURFS TEST (CEFT)
B) THE MOTOR FREE VISUAL PERCEPTION TEST (MVPT)

Source	n	Pre-test mean	Post-test mean	Adjusted post-test mean
Perceptual Principles Group 1	25	A) 11.76	16.24	16.39
		B) 29.80	31.48	30.99
Elements of Design Group 2	25	A) 11.96	14.08	14.43
		B) 28.92	31.36	31.44
Control Group 3	25	A) 13.76	13.64	13.14
		B) 28.28	31.08	31.49

The CEFT pre-test means for all groups in this study indicated close performance relationships with the Control Group being high and the Elements of Design Group being low. The Perceptual Principles Group recorded the greatest performance gains on the CEFT, while the Elements of Design Group also made gains, but of a slightly smaller nature. The Control Group remained at about the same level on this measure.

The MVPT pre-test means of the three groups again showed relatively close performance relationships. The Perceptual Principles Group and the Elements of Design Group showed only slight improvements in performance on the MVPT post-test. The Control Group showed slightly more improvement than the other two groups on this instrument, but none of the groups made significant performance changes.

The adjusted post-test means for all groups were subjected to univariate analysis of covariance techniques which yielded the F-ratios and significances reported in Tables 3 and 4.

TABLE 3

CEFT INSTRUMENT SUMMARY OF ANALYSIS OF COVARIANCE DATA FOR ADJUSTED POST-TEST SCORES FOR THE CHILDREN'S EMBEDDED FIGURES TEST FOR PERCEPTUAL PRINCIPLES GROUP 1, ELEMENTS OF DESIGN GROUP 2, AND GROUP 3

Source	Adjusted Sum of Squares	Degrees of Freedom	Adjusted Mean Squares	F-ratio
Perceptual Principles Group 1 to Control Group 3	122.9680	1	122.9680	14.8005**
Elements of Design Group 2 to Control Group 3	21.2115	1	21.2115	2.4327 N.S.
Perceptual Principles Group 1 to Elements of Design Group 2	47.3480	1	47.3480	5.6988*
Error	581.5810	70	8.3038	

*p. < .05
**p. < .01

The F-ratio of 14.8005 obtained between the Perceptual Principles Group and the Control Group was significant well beyond the .01 level of confidence. The critical range required a value of 7.01 for F-ratios to be significant at the .01 level. The F-ratio of 2.4327 obtained between the Elements of Design Group and the Control Group was not significant. The F-ratio of 5.6988 obtained between the Perceptual Principles Group and the Elements of Design Group was significant beyond the .05 level of confidence. An F-ratio of 3.98 was needed to achieve the critical range at this level.

Overall, the results of analysis of CEFT scores indicated strong performance gains by subjects participating in the Perceptual Principles Group when compared to both the Elements of Design Group and the Control Group. Data analysis of performance differences between the Elements of Design Group and the Control Group, however, was inconclusive.

Subject performance as measured by the Motor-Free Visual Perception Test (MVPT) was utilized in the analysis of treatment effects. All of the reported F-ratios in this analysis failed to reach the critical levels necessary for the acceptance of the Directional Hypotheses, therefore the null hypotheses were not rejected.

Multivariate trend analysis techniques were employed to evaluate group performance on photographic tasks since these data were generated as a function of the experimental treatments. To assist in visualizing the obtained differences in group performance, a graph of mean score performance levels on the DPRS has been presented in Table 5.

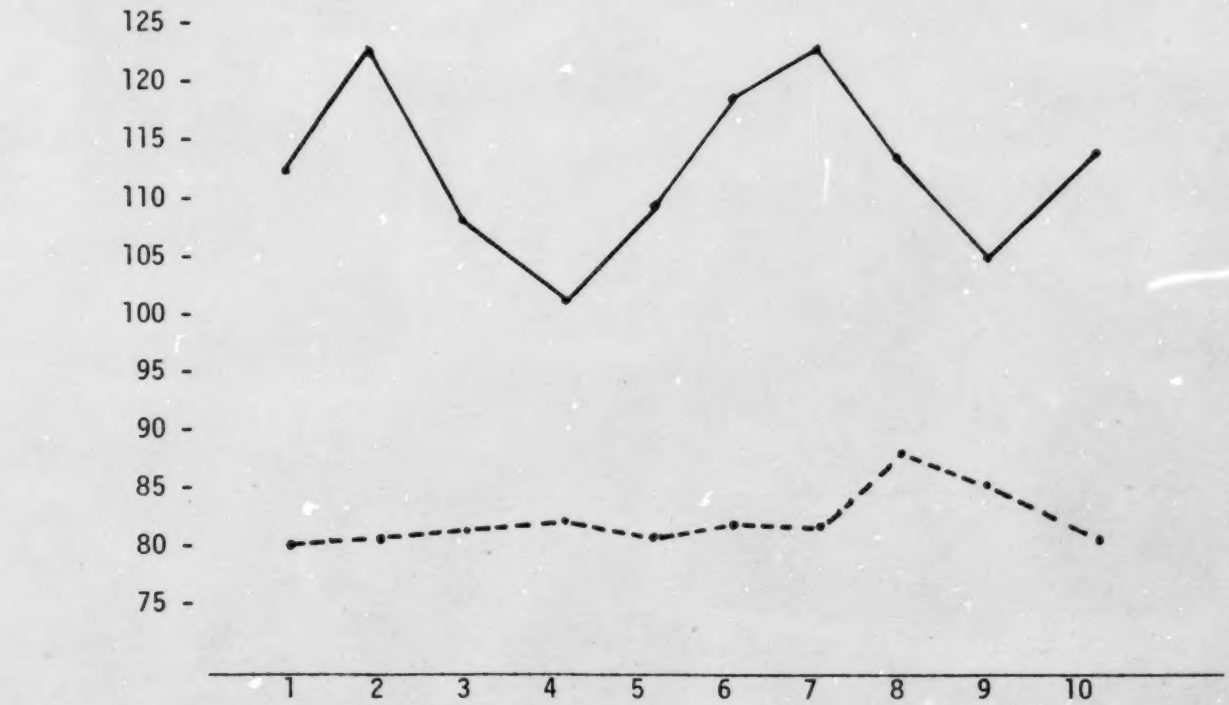
TABLE 4

MVPT INSTRUMENT SUMMARY OF ANALYSIS OF COVARIANCE DATA
FOR ADJUSTED POST-TEST SCORES FOR
THE MOTOR-FREE VISUAL PERCEPTION TEST FOR
PERCEPTUAL PRINCIPLES GROUP 1, ELEMENTS OF DESIGN GROUP 2,
AND CONTROL GROUP 3

Source	Adjusted Sum of Squares	Degrees of Freedom	Adjusted Mean Squares	F-ratio
Perceptual Principles Group 1 to Control Group 3	3.0013	1	3.0013	0.4391 N.S.
Elements of Design Group 2 to Control Group 3	0.0356	1	0.0356	0.0052 N.S.
Perceptual Principles Group 1 to Elements of Design Group 2	2.5460	1	2.5460	0.3725 N.S.
Error	478.4290	70	6.8347	

TABLE 5

A GRAPH OF DUNN PHOTOGRAPHIC RATING SCALE (DPRS) MEAN SCORES FOR PERCEPTUAL PRINCIPLES GROUP 1 AND ELEMENTS OF DESIGN GROUP 2 OVER FIVE TREATMENTS WITH TWO MEASURES IN EACH TREATMENT



An examination of the information contained in Table 5 disclosed that Perceptual Principles Group 1 consistently performed at higher levels than Elements of Design Group 2 as measured by the rating scale. In as much as initial measures of photographic performances were begun as the culminating activity of the first treatments in each group,

however, some initial performance differences between groups could be expected. Variation in performance levels within Perceptual Principles Group 1 as demonstrated by fluctuations in DPRS means may point toward the isolation of individual treatments that were more effective than others. Perceptual Principles treatments 1 - Point of View, 3 - Motion, and 4 - Points of Maximal Information elicited the highest levels of student performance.

DPRS mean scores for Elements of Design Group 2 were less varied than the mean scores for Perceptual Principles Group 1. None of the individual treatments for this group could be identified as being significantly more efficient in eliciting increased levels of visual differentiation from these subjects.

The computer generated analysis of DPRS performance, which has been summarized in Table 6, illuminated significant differences among and between groups. An overall multivariate F-ratio of 5.1228 was significant beyond the .01 level of confidence. An F-ratio of 2.88 was necessary to achieve this level of confidence. In addition, analysis of performance between groups yielded a multivariate F-ratio of 13.7552 which was well beyond the .01 level of confidence. The critical level necessary to achieve this confidence level was 2.81.

The information and problem solving approach presented during the Perceptual Principles Group treatments may have: 1) strongly affected the visual differentiation levels of the group, or 2) provided a more efficient means for the exhibition of previously attained percepts by the subjects. Conversely, Elements of Design Group 2 performed at a significantly lower level than Perceptual Principles Group 1. No

individual treatments could be isolated as being potentially powerful stimulators of increased levels of visual differentiation in children, and any gains in visual differentiation levels achieved by this group were considered to be inconclusive.

TABLE 6

DUNN PHOTOGRAPHIC RATING SCALE SUMMARY OF MULTIVARIATE TREND ANALYSIS FOR PERCEPTUAL PRINCIPLES GROUP 1 AND ELEMENTS OF DESIGN GROUP 2

Source	df	Adjusted Mean Squares	Univariate F	Step down F	Multi-variate	(df)
Overall					5.1228**	9/40
Measure	1	293.3780	3.0220	3.0220		
Time					4.0600	4/44
Linear	1	2924.1000	5.9306*	8.9696**		
Quadratic	1	17.8314	0.0294	0.2314		
Cubic	1	2890.0000	4.8371*	6.4288*		
Quartic	1	125.1566	0.2823	0.0420		
Measure by time					2.3647	4/39
Linear	1	217.1477	6.1271*	6.1271*		
Quadratic	1	129.3933	5.4195*	1.3247		
Cubic	1	13.2656	0.9122	0.0670		
Quartic	1	90.3627	5.7685	1.8972		
Groups					13.7352**	10/39
Constant	1	97972.0020	61.4127**	61.4127**		
Measure	1	120.0500	1.2366	15.1699**		
Time					2.3970	4/43
Linear	1	3556.9960	7.2142**	2.8023		
Quadratic	1	1278.7457	2.1096	0.0039		
Cubic	1	4717.5840	7.8959**	6.6456*		
Quartic	1	99.8423	0.2252	0.0615		
Measure by time					2.2059	4/39
Linear	1	318.7763	8.9946**	8.9946**		
Quadratic	1	92.6499	3.8805	0.2213		
Cubic	1	27.7426	1.9077	0.1802		
Quartic	1	11.4562	0.7313	0.0000		

*$p < .05$
**$p < .01$

DISCUSSION

The findings of this investigation tend to be consistent with the theoretical positions expressed by Piaget (1956), Gibson (1969), and Gagne (1970). The position that visual perceptual levels in children can be enhanced by a guided discovery, problem solving approach that encourages firsthand experiences in the environment while minimizing the importance of psychomotor development has been supported. In addition, the evidence is also in accord with previous art education studies by Salome (1965) and Dorethy (1972) that dealt with principles of visual perception as possible affectors of visual perceptual growth.

Analysis of covariance data compiled on all three groups on the CEFT indicated that the Perceptual Principles Group made significantly greater performance gains than either the Elements of Design Group or the Control Group. These gains may, therefore, be attributed to the experimental treatment. Similar comparisons between the Elements of Design Group and the Control Group were inconclusive. Analysis of these data suggested that further study may be required to illuminate the presence of any significant differences due to this treatment methodology.

Analysis of covariance data compiled on all three groups on the MVPT failed to disclose any significant differences between the groups on the performance required by this task. One possible reason for this lack of significance may lie in the fact that each of the groups scored highly on the pre-tests and had very limited opportunity to exhibit improvements in performance on the instrument.

Analysis of performance during the photographic activity portions of this investigation also resulted in the identification of significant

differences between the Perceptual Principles and Element of Design Groups. The Perceptual Principles Group performed at a significantly higher level than the Elements of Design Group as rated by the DPRS. Although the evidence supported the contention that the traditional art information supplied by the Elements of Design treatments could be redundant, more research should be performed before this position should be unequivocably adopted.

The most important general finding in this experiment, however, is the facilitating effect between Visual Problem Solving methodologies and photographic activity by children. Increases in visual perceptual peformance by Perceptual Principles Group 1 provide strong support for instructional strategies that seek to guide children in the formation of higher order rules, and contiguity in the application of these guidelines. In addition, the evidence tentatively suggests that the photographic medium provided a form of visual perceptual activity that increases the mobility of the perceiver, thereby increasing the perceiver's firsthand experiences with the environment. This medium also de-emphasizes the psychomotor skills necessary to exhibit a new percept in visual form.

The following general conclusions can be drawn based on the analysis of the findings of this investigation. A direct, positive relationship may exist between instructional methodologies that emphasize Visual Problem Solving activities in conjunction with Principles of Perception that seek to orient the student toward active experiences in the environment. The findings support the position that visual principles rather than visual qualities are more efficient in eliciting perceptual development in children. The combination of Visual Problem Solving strategies and

Perceptual Principles evidently influenced subjects to attend to aspects of the visual array in a more specific or differentiated manner as measured by the CEFT. In effect, the state of contiguity encouraged by Visual Problem Solving and the information or orientation provided by the Perceptual Principles may have allowed the subjects to process visual information more efficiently, thereby leading to higher order solutions to the visual tasks that were assigned. This contention was also supported by the results obtained through evaluation of the photographic images by the DPRS.

Conversely, significant results were not obtained when Visual Problem Solving strategies were incorporated with the traditional art concepts regarding the Elements of Design. Since the variables of mobility and direct experiences in the environment were approximately equal for both experimental groups, the evidence suggests that the prime affector in performance differences was limited to the qualitative or superficial nature of the Elements of Design information.

Analysis of inter-rater correlations on the Dunn Photographic Rating Scale supported the position that this instrument possesses high levels of reliability over a large sampling. Judges appeared to be able to employ the scale in a consistent fashion, and although only face and content validity can currently be assumed, the DPRS served to illuminate significant differences between groups. Correlations on this instrument were well beyond the .01 level of confidence, and the evidence implies that this scale provided a valid and reliable measure of photographic performance by the experimental groups. The Dunn Photographic Rating Scale could be employed in studies that require critical appraisal

of visual performance or products of visual performance in a variety of visual media. In addition, after further validation, the DPRS could be employed in a closer examination of Piaget's notions concerning the indeterminate length of time between an initial perception and the first observable evidence of that percept.

Replication of this investigation with an additional group or groups that function with traditional art media is indicated, as are replications with other age levels and geographic populations. The utilization of a sample taken from a laboratory school situation may well not be typical of the overall population.

Finally, the results of this research can be used to further justify the inclusion of photographic activities within all levels of the educational environment. "There is no need to conceive of photography as a replacement for painting or sculpture or printmaking, but rather it can be welcomed as an additional vehicle to promote whichever purposes are considered important to the art program" (Lanier, 1966, p. 86).

Each of us is a consumer of visual images (Feldman, 1976). Children are bombarded by hundreds, perhaps even thousands, of photo-generated images daily. The results of this investigation supports the position that young children can deal effectively with the technology, aesthetics, and information engendered by this medium if given the opportunities and training to do so.

Phillip C. Dunn is Director of Graduate Studies in Art and Assistant Professor of Art, The University of South Carolina, Columbia, South Carolina.

REFERENCES

Allport, G. Becoming. New Haven: Yale University Press, 1955.

Attneave, F. Some informational aspects of visual perception. Psychological Review, 1954, 61 (3), 183-193.

Barley, S.D. Why visual sequences come first. Bethseda, Md.: ERIC Document Reproduction Service. ED 057 584. 1969.

Colarusso, R.P. and Hammill, D.D. Motor-free visual perception test manual. San Raphael, Cal.: Academic Therapy Publications, 1972.

Collier, G. Form, space and vision (2nd ed.). Englewood Cliffs: Prentice-Hall Inc., 1967.

Debes, J.L. The eyeful power. Bethseda Md.: ERIC Document Reproduction Service. ED 108 658. 1975.

Dorethy, R.E. Motion parallax as a factor in the differential spatial abilities of young children. Studies in Art Education, Winter 1972, 14 (2), 15-27.

Fransecky, R.B. Visual literacy and teaching migrant youth. Betheseda Md.: ERIC Document Reproduction Service. ED 066 906. 1972.

Feldman, E.B. Art, education, and the consumption of images. In The Arts, human development, and education. Berkeley: McCutchan Publishing Corporation, 1976, 137-149.

Gagne, R.M. The conditions of learning (2nd ed.). New York: Holt, Rinehart and Winston, Inc., 1970.

Gibson, E.J. Principles of perceptual learning and development. New York: Appleton Century Crofts, 1969.

Hurwitz, E.A. Design: a search for essentials. Scranton: International Textbook Company, 1964.

Lanier, V. Final report of the uses of newer media in art education project. N.A.E.A., 1966.

Linderman, E.W. and Herberholz, D.W. Developing artistic and perceptual awareness. William C. Brown Company, 1974.

Ohrn, K,B. Re-viewing photographs: Unexplored resources for communication research. Bethseda Md.: ERIC Document Reproduction Service. ED 128 851. 1976,

Piaget, J. Development et apprentissage perceptif. Proc. Sixteenth International Congress of Psychology, Bonn: 1960, 323-325.

Piaget, J. The child's conception of space. New York: Humanities Press, 1956.

Salome, R.A. The effects of perceptual training upon the two dimensional drawings of children. Studies in Art Education, Winter 1965, 13 (2), 3-8.

Salome, R.A. and Szeto, J. The effects of search practice and perceptual training upon representational drawing. Studies in Art Education, 1976, 18 (1), 49-52.

Tryon, R.C. Reliability and behavior domain validity: Reformulation and historical critique. Psychological Bulletin, 1957, 54, 229-249.

Villa, C. When young children use cameras. Visual Literacy Yearbook, Bethseda Md.: ERIC Document Reproduction Service. ED 086 266. 1973.

Witkin, H.A., Oltman, P.K., Raskin, E., and Karp, S.A. A manual for the embedded figures tests. Palo Alto: Consulting Psychologists Press, Inc., 1971.

Yochim, L.D. Perceptual growth in creativity. Scranton: International Textbook Company, 1967.